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THERAPEUTIC MASSAGE TO TREAT NORMAL PHYSIOLOGICAL ANKLE AND FOOT EDEMA IN LATE PREGNANCY

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ABSTRACT

Venous insufficiency leads to bilateral lower extremity edema in advancing healthy pregnancies affecting women's quality of life by generating a variety of discomforts, the most of which are pain, cramps, and heaviness. The goal of the study was to collect evidence of how well therapeutic massage reduced the typical physiological edema of the ankle and foot that develops in late pregnancy. The study aimed to assess the effectiveness of therapeutic massage in reducing physiological ankle and foot edema during late pregnancy. Methods: A two-group randomized control trial was performed on 264 pregnant women between 28-38 weeks gestation devoid of any complication in outpatient clinics of a tertiary care hospital in Karachi, Pakistan. In each group, 132 participants were assigned to routine care and therapeutic massage groups through simple randomization. Results: The response rate was 90.2%. Both treatments were found significantly effective in reducing ankle and foot edema ($p<0.0001$) in late pregnancy. However, all bilateral mean measurements of the massage group confirmed greater decreases in edema as compared to the routine care group. Conclusion: Therapeutic massage was found to be a more effective and superior alternative to routine care to combat physiological lower extremity edema during late pregnancy.

Keywords: Pregnancy; Foot Edema; Massage; Complementary Medicine; Alternative Medicine

INTRODUCTION

Visible, dependent peripheral edema is a prevalent complaint of advancing pregnancy.(Kent *et al.*, 1999; Mollart, 2003; Hartmann *et al.*, 2005; Çoban *et al.*, 2010) Along with numerous other physiological changes in a healthy pregnancy, the presence of edema subsequently leads to discomfort, feeling of heaviness, painful paranesthesia, gait disturbance and issues of self-image.(Koo *et al.*, 2010; Shaho, 2010; Nazik *et al.*, 2014; Maputle *et al.*, 2015) Some women are convinced to find it normal; others perceive it troublesome as it perverts their quality of life.(Bamigboye *et al.*, 2007; Watanabe *et al.*, 2017) In a socio-cultural context, pregnancy is not perceived as confinement to bed but pregnant women aspire for respectful and quality care during pregnancy (Arnold *et al.*, 2018) Spiritual and cultural beliefs restrain women from seeking the assistance of healthcare providers however, it becomes essential to implore for help when it starts affecting their daily activities. (Field *et al.*, 1999) The reported prevalence of normal ankle and foot edema during late pregnancy in literature was 80%(Mollart, 2003) (Mollaelahi *et al.*, 2022) but according to anecdotal reports of obstetricians, it is found in more than 90% of all pregnant women. Edema is an overt, palpable accumulation of excess fluid in the interstitial spaces (Watanabe *et al.*, 2017). Pitting edema of ankles, and feet can

be severe enough to leave an indentation (pit) that stays for some time after release. Hydrostatic and colloid oncotic pressure regulates the intravascular and interstitial fluid. In late pregnancy, the developing uterus compresses the pelvic veins and inferior vena cava, triggering fluid retention (Mollaelahi *et al.*, 2022; Patola *et al.*, 2022). Blood pressure in the leg veins is raised, resulting in venous insufficiency and edema. The mounting weight of the gravid uterus, the peak levels of the progesterone, prolong standing and gravitational effects are the fundamental contributory factors causing inadequate movement of blood upward from the lower extremities (Kang *et al.*, 2015; Smyth *et al.*, 2015; Field, 2016). Bed rest with elevation of the legs and limiting the salt intake is the commonly advised treatment to control edema (Kent *et al.*, 1999). Complementary and Alternative Medicine (CAM) therapies are health-associated practices integrated with conventional medicine to allay multiple health issues (Jawed *et al.*, 2019). CAM modalities have thrived and gained popularity throughout the centuries for minor illnesses to devastating situations when conventional medicine is perceived to be ineffective, or toxic with unbearable adverse effects (Hughes *et al.*, 2018). Even though there have been revolutionary advancements in current systems of treatment, customary methods of healing are still being used across the globe. Strong beliefs, cultural norms, and traditional practices of using CAM therapies, often direct people to employ non-pharmaceutical methods. CAM use is also popular to treat gynecological issues in many cultures (Mollart *et al.*, 2019).

CAM therapies are interwoven into the current healthcare paradigm and midwifery care (Kavurmaci *et al.*, 2018). Various surveys confirm that nurses find complementary techniques safe and concurrent with modern medicine (Kandeel *et al.*, 2019). In many countries, CAM is also gaining the interest of nursing managers who recommend using these therapies during and after pregnancy due to their many benefits and rare hazards (Mollart *et al.*, 2019). Few non-pharmacological interventional studies are conducted by nurses to treat edema in the ankle and feet. A single water exercise session for 45 min was carried out by Hartmann and Huch (Hartmann *et al.*, 2005) on 9 pregnant women and it was found to significantly lowering bilateral lower leg edema. A comparison of water aerobics and static immersion session each for 30 minutes was conducted by Kent et al,.1999 on 18 women at 20-30 weeks of pregnancy. Static emersion was effective to decrease edema. The researcher (Mollart, 2003) used two reflexology techniques versus bed rest of 15 min duration on 55 women in late pregnancy and found non-significant edema-relieving effects. Manual lymph drainage therapy was tried by (Cataldo Oportus *et al.*, 2013) on 15 women at 20-32 weeks gestation for one hour and significant results were obtained. The effectiveness of these treatments fluctuated between high to low. The safety and efficacy impact of these therapies is yet to be proved scientifically through copious well-designed studies. Therapeutic foot massage is considered a non-medicated treatment modality for soft tissues. It uses Swedish techniques of manipulating, rubbing and pressing with fingers and hands to reduce edema, muscle spasm and fatigue during pregnancy (Taylor *et al.*, 2018; Jawed *et al.*, 2019).

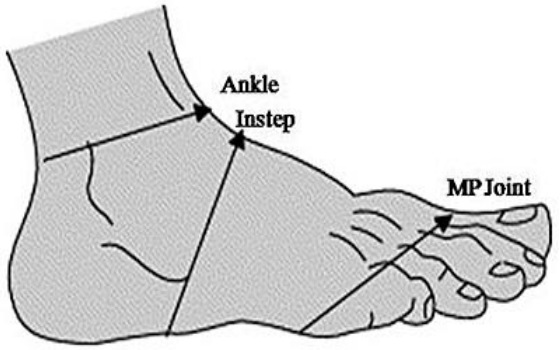
METHODS

Randomized control trial study design was used in this study as the target population was randomly allotted to a treatment. The two treatment effects were observed and compared in the clinical trial. The Study was conducted in antenatal clinics of Civil Hospital Karachi, Pakistan from April to July 2017. We included women with healthy, uncomplicated pregnancies of 28-38 weeks gestation, registered and attending antenatal clinics regularly, visible and clinically present bilateral ankle and foot edema, having a history of normal blood pressure ranges throughout pregnancy and with no history of known medical diagnosis. Women diagnosed with pre-eclampsia, eclampsia, unilateral and painful swelling, cellulitis, blisters and ulcer of the lower leg, and having known medical diagnosis, psychiatric disorder, or taking anti-depressants and antipsychotic medications were excluded. Sample size was calculated using PASS Version 11 repeated measure analysis of

variance with 80% power of the test and 95% confidence interval, Means of edema measurement of right MP (metatarsal phalangeal) joint 23.81 cm at day 0 and 24.4 cm at day 5 in control group and Means of edema measurement of right MP joint 23.71 cm at day 0 and 23.5 cm at day 5 in the experiment group of a previous study.[1] Calculated sample size was 264 pregnant women, 132 in each group. During the study, 13 participants out of 132 from each group lost to follow-up, therefore 119 participants per group completed the sessions of treatment. By simple random sampling technique, 20 registered pregnant women in the third trimester, from the antenatal clinics, were enrolled weekly by order of their arrival for the antenatal visit and meeting the inclusion criteria for this randomized control trial. After taking their verbal and written consent, the participants were pair-matched for homogeneity of their age, parity, and gestational age. 20 Paper slips were made with codes 1-10 (Experiment-1 and Control-1, Experiment-2 and Control-2, and so on till 10), slips of each homogenous pair were tossed on a desk and the pair was divided into the control and experimental groups depending on the slip they picked. The pair of samples was randomly assigned a treatment. This procedure of sampling technique was repeated weekly for new induction of 10-12 women per group. Edema was measured using two validated methods. The Circumference Measurement Method of Assessment using (Steel Tape GW-F213) a tension-controlled measuring tape (Coban, 2010; Mollart, 2003; Taylor J, Hicks CW, Heller J. 2018). The second method was the Assessment of Pit Depth Recovery Time.[24] Figure 1 shows areas of measurements, ankle circumference above the malleoli, instep circumference over the cuneiform and cuboid bones and the circumference of the metatarsal-phalangeal joint (Mollart, 2003). Pit Depth Recovery Time was recorded in two areas, the midpoint of the medial malleolus and the dorsum of both feet (over intermediate cuneiform).

Figure 1

Areas of circumference measurement



Data Collection Procedure

Figure 2 illustrates that data were collected for both groups on day 0 before the intervention and day 7 after the intervention. The questionnaire was filled out by the primary researcher along with the participant. Personal and obstetrical data were taken from participants' files and verified by asking them. All edema circumference measurements of the right and left foot were taken in cm of the ankles, insteps and MP joints while they were in a sitting position with feet flat on the floor. Pit depth recovery time was measured while equal pressure was applied at the same time, at the midpoint of the medial malleolus with thumbs holding the ankles circumferentially, for 10 seconds that caused an indentation after releasing pressure, the recovery time of two areas of right and left foot was recorded in seconds. The procedure was repeated using the index finger for applying pressure over the dorsum of each foot. The response of the Treatment group about the therapeutic massage was also asked and noted on the last day of a treatment session. Ethical approval was sought from the institutional review board of Dow University of Health Sciences (Ref: IRB-799/DUHS/Approval/2016/328). A permission letter was taken from the Medical Superintendent of the hospital; the letter was further signed by the in-charge Outpatient department and Antenatal clinics to conduct the study. The purpose, risks and benefits of the study were explained to the participants who accepted to participate. Their quarries were answered which motivated them to participate. After providing detail about the aim

of the research, procedure, benefits and risks, verbal and written consent were taken from them. Moreover, all participants were informed about their right to withdraw at any point during the data collection. The confidentiality and anonymity of participants' data were maintained by using codes on data collection forms instead of names.

Treatment Protocol for the Two Groups

Protocol for Therapeutic massage/Treatment Group

The treatment group was given a therapeutic massage. A protocol was followed before initiating the procedure; specific skills of foot massage for pregnant women were learnt and practiced under the guidance of a physiotherapist. Deep acupressure points in the sole of feet which could induce labor and vigorous movements were avoided (Hughes CM, Liddle S, Sinclair M, McCullough JE. 2018; Mollart L, Stulz V, Fourier M. 2019). Pace of the manual movements was maintained, not too fast and not too slow. The participant's facial expressions were observed for any sign of discomfort during the procedure. All techniques were repeated at least ten times for each foot. Mild, non-allergic and absorbable baby oil (Johnson & Johnson, New Jersey, USA) was used for smooth massage movements. It was made certain that oil was well absorbed and after the massage feet were wiped with tissues, preventing any chance of possible slipping. Participants were informed not to perform foot massages by themselves which might trigger premature labor. Therapeutic massage was given by the principal researcher to 10-12 participants of the study group for 7 days, at a set time as per the convenience of the participants between 9 am to 2 pm; 10 min to each foot. The massage was started with alternate foot daily, with the right foot on the first day and the left foot on the second day for all participants inducted weekly, and each session lasted for 20 minutes daily.

Protocol for Control Group

The control group received standard routine care and was advised to rest with elevating lower legs using one or two pillows to decrease edema using the principle of gravity during the day (Arnold R, Van Teijlingen E, Ryan K, Holloway I. 2018), limits the salt and oily food intake, increase water intake from 10 to 12 glasses per day and stretch their feet up and down and in circular motion frequently to improve circulation.

Massage Procedure Followed

The massage was conducted with a combination of Swedish massage techniques. Effleurage technique, with sliding/gliding movements of long strokes, was used, while holding the foot with one hand firmly and stroking gently with the dominant hand, applying light pressure and slowly adding more, moving from toes towards the ankle directing the lymph flow upwards (Coban A. 2010).

The petrissage technique was used while holding the foot with both hands for circular movements using thumbs in between each tendon from the toes towards the ankle. Both hands were used to massage the ankle in a circular motion around the bone on either side gently and with fingers and thumb over the top of the bone.Lastly, mobilization and stretching movements were performed of the foot using both hands, with one hand grasping the foot and with the other hand moving the foot side to side, back and forth and in a circular movement. The toes were held with one hand while supporting the foot with the other hand gently bending and stretching the toes backwards and forwards. The massage concluded with slow and gentle effleurage movement. The same techniques were carried out for the other foot for 10 min each and repeated daily in the same manner for a total of 20 min.

DATA ANALYSIS

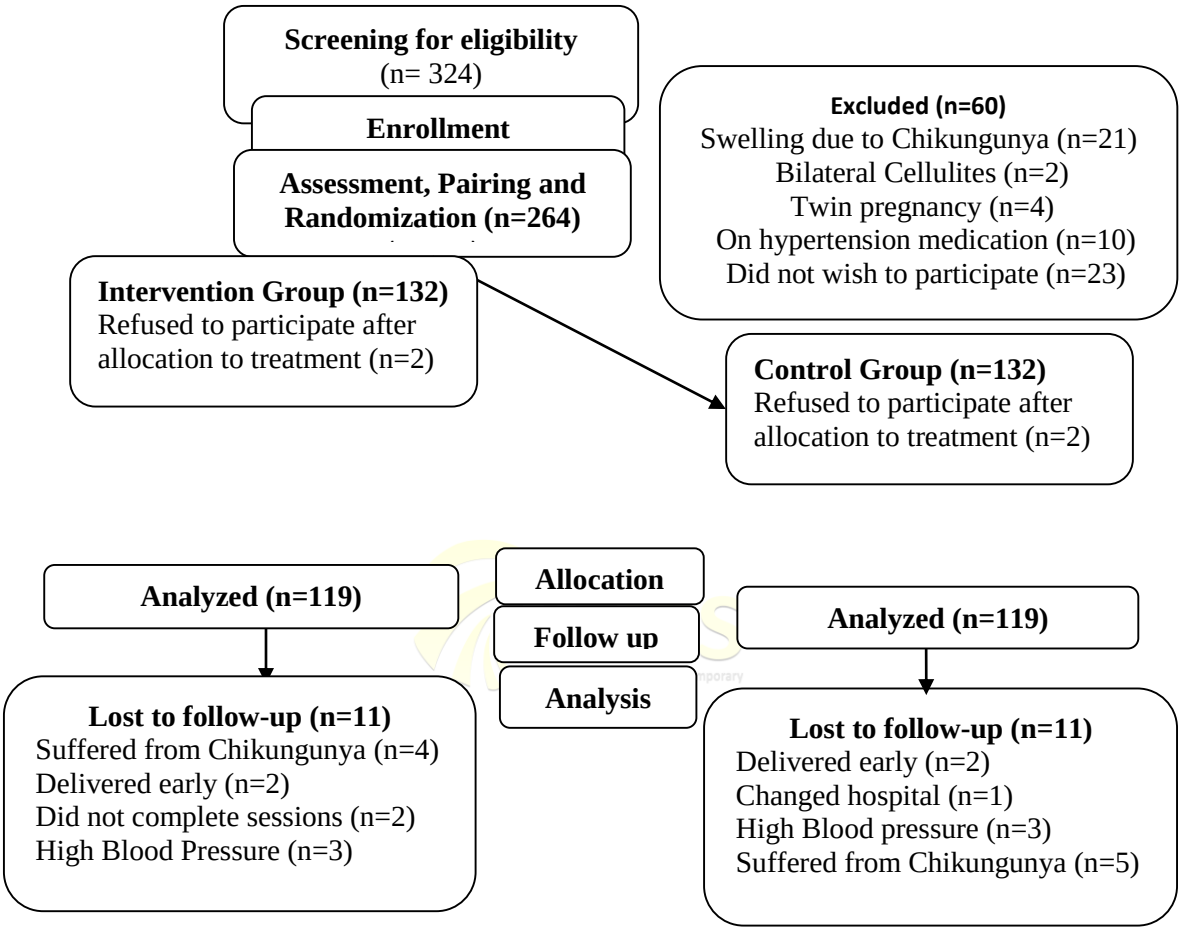
Data were entered and analyzed using Statistical Package for Social Sciences version 21.0 (IBM SPSS Base Licensed) computer software program. The means, standard deviations, and ranges were computed for the continuous variables. Repeated measure ANOVA was applied for each pre and post-foot and ankle edema measurement. A p-value of less than 0.05 was considered significant. Participants' responses were presented in percentages.

RESULTS

Out of 324 women invited and screened for eligibility, 264 were allocated to control and treatment groups. Only 238 participants completed the treatment sessions. (Fig.3)

Figure.3

Flow Chart of Participants' progress



Results of Demographic Characteristics

Table 1 illustrates that in a control group, the average age of participants was 25.15 (±4.4; range 16-35) years, married for 4.69 (±3.7) years, conceived 2.3 (±1.4) times, the number of alive children was 1.09 (±1.2), length of pregnancies remained 32.7 (±2.7) weeks and average weight 143.8 (±22.6) pounds. Respectively, in the treatment group, the similar averages were; 24.96 (±3.7; range 18-34), 3.6 (±3.4), 2.1 (±1.3), 0.9 (±1.1), 32.9(±2.8), 138.9 (±26.02). Participants with raised Blood pressure during the treatments were eliminated from the study while others' blood pressure remained in normal ranges pre-post interventions.

Table.1

Descriptive statistics of demographic and obstetrical features

Demographic and obstetrical Features of Participants by Group						
	Control Group (N= 119)			Treatment Group (N=119)		
Variables	Mean	Range	SD	Mean	Range	SD
Age (years)	25.15	16-35	4.41	24.96	18-34	3.76
Marriage (Years)	4.64	0.10-15	3.79	3.64	0.10-13	3.48
Gravidity	2.34	1-6	1.42	2.19	1-6	1.35
Parity	1.09	0-4	1.22	0.9	0-4	1.17
Gestational Age (weeks)	32.71	28-38	2.73	32.92	28-38	2.85
Weight (pounds)	143.85	90-193	22.62	138.97	92-211	26.02

SD; standard deviation

Effectiveness of Therapeutic Massage and Routine care

Results of therapeutic massage as well as of routine care proved to significantly lower edema of the ankle and feet but the control group revealed small decreases when compared to the treatment group. The p- values identified by the treatment group as well as of control group participants were statistically significant (All P-values <0.05). In the control group, the left instep and left MP joint, mean measurements were found to be the lowest (Table.2).

Table.2

Difference in pre-post Mean circumference and mean pit depth recovery time measurements in cm and sec.

		Treatment group (n=119)			**Control group (n=119)**			
Variable		Mean Before	Mean After	**Difference in cm**	Mean Before	Mean After	**Difference in cm**	**P-value**
Right	Ankle	20.24	20.05	**0.19**↓	20.74	20.65	**0.09**↓	0.0001**
	Instep	22.28	22.07	**0.21**↓	22.47	22.38	**0.09**↓	0.0001**
	MP joint	21.22	21.02	**0.20**↓	21.42	21.38	**0.04**↓	0.0001**
Left	Ankle	20.29	20.07	**0.22**↓	20.78	20.66	**0.12**↓	0.0001**
	Instep	22.05	21.92	**0.13**↓	22.34	22.29	**0.05**↓	0.043*
	MP joint	21.18	21.03	**0.15**↓	21.37	21.35	**0.02**↓	0.036*
The difference in average pit depth recovery time measurement in sec								
Right	Malleolus	42.78	29.95	**12.83** ↓	47.87	39.50	**8.37** ↓	0.0001**
	Dorsum	8.85	5.29	**3.56** ↓	10.71	8.4	**2.31** ↓	0.0001**
Left	Malleolus	46.47	30.99	**14.92** ↓	52.21	42.32	**9.89** ↓	0.0001**
	Dorsum	8.76	4.86	**3.9** ↓	11.08	8.26	**2.82** ↓	0.0001**

**Highly significant P-value <0.001, *Significant P-value< 0.05. A decrease in measurement is denoted by ↓ a mark. MP joint; metatarsal–phalanges joint, cm; centimeter, sec; seconds

Repeated Measure ANOVA compared means of pre-post intervention measurements of right and left ankle and foot identified in Figures3 a-f that both interventions were effective in reducing edema of all areas but the effect size was different for the two interventions. Within a day all P-values <0.0001 indicated statistically significant effects of two interventions over some time. The

P-value between groups was <0.05 indicating a significant difference between groups.

Figure 3.

A-F Pre- Post-Intervention Mean Circumference measurement comparison of the right and left ankle and foot between groups

Fig. A Right Ankle Fig. B Right Instep Fig. C Right MP joint

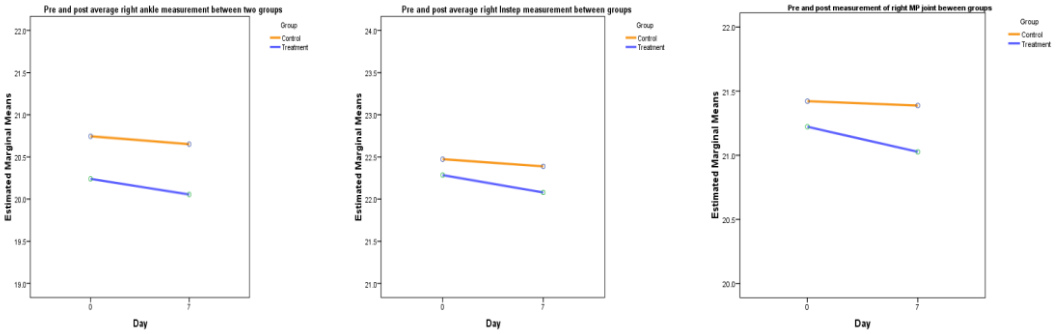


Fig. D Left Ankle Fig. E Left Instep Fig. F Left MP Joint

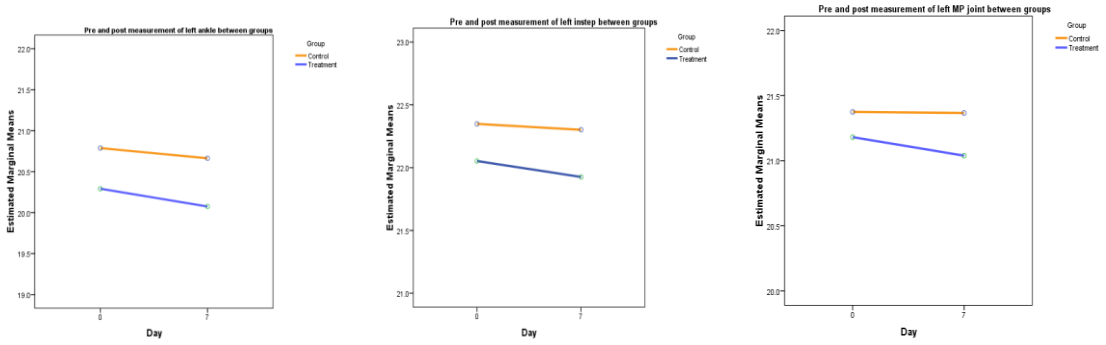
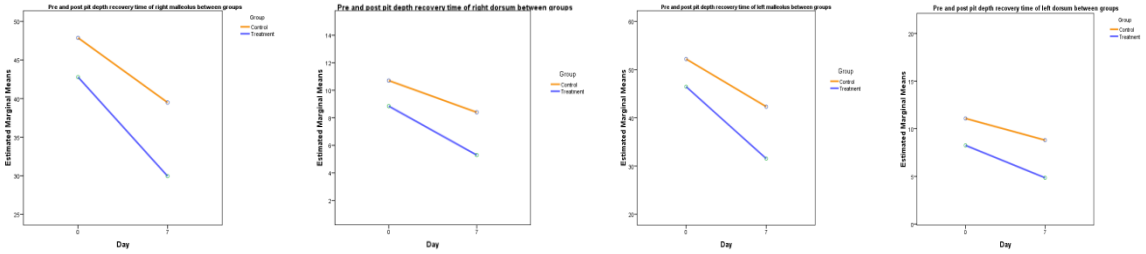


Figure 3.

G-J Pre- Post-Intervention Mean measurement comparison of Pit depth recovery time of the right and left malleolus and dorsum of two groups

Fig. G Right Malleolus Fig. H Right Dorsum Fig. I Left Malleolus Fig. J Left Dorsum



Participants Responses after Therapeutic Massage

Figure 3.4 illustrates the response of participants after the therapeutic massage was encouraging. Out of 119 participants, nearly 79 % commented having positive effects. Just about 25 % responded that they felt 'slightly better'. Almost 13 % stated that it was 'comforting'. About 11 % felt 'much better'. Practically 9 % found it 'very effective'. Approximately 7 % replied that they felt 'better'. Only 6 % perceived that foot massage was 'relaxing'. Around 5 % experienced that their 'shoe fits easily'

and they walked better and just above 3 % reported that they 'felt lighter' after massage sessions. About 21 % of them informed, they 'did not find any change'.

DISCUSSION

The intention of carrying out the study was to confirm the effectiveness of therapeutic massage in reducing normal physiological ankle and foot edema in late pregnancy on 238 pregnant women which was a large sample size as compared to previous studies conducted in Turkey, Australia, Switzerland, Sao Paulo and Oregon using various alternative therapies. The data of edema
measurements were also collected using two different methods in contrast to other studies which used only a single method for measurement of edema. Repeated Measure ANOVA established the results of two interventions that support the hypothesis of this study. The mean circumference pre-post measurements of the ankle, instep and MP joints bilaterally of both the groups revealed statistically significant (p-<0.001) decreases in all right and left mean circumferences. Similarly, pit depth recovery time all mean measurements of the right and left malleolus and dorsum of the two groups, P-values within a day over some times were p-< 0.0001, indicating statistically significant effects of both interventions. However, the lowest decreases were recorded of the left instep (p-<0.043) and left MP joint (p-<0.036) of the control group. These results are consistent with the earlier study conducted in Turkey[1] using massage therapy for 20 min daily for 5 days to 40 women. It confirmed being effective in comparison to the control group. No benefit was noted from routine care in this study because all mean measurements were higher than before. Where in our study, in the control group all mean measurements also decreased but to a lower extent than the therapeutic massage. The results of the current study are also harmonious with the findings of prior studies done using alternative complementary therapies which aimed to reduce normal physiological lower leg edema. These studies included lymphatic reflexology by Mollart, 2003, single immersion exercise session by Hartmann and Huch, 2005, a comparison of water aerobics and static immersion by Kent, et al, 1999 and lymph drainage by Cataldo et al, 2013. Studies concluded finding the effectiveness of these therapies in reducing edema of the ankle and feet in late pregnancy. Hence, the sample sizes were small and treatment sessions were also fewer to assess the efficacy and safety of these methods. The difference in lifestyles, cultures of the study population, setting, and provision of health education as well, make it difficult to compare the results. However, in contrast, to the study carried out in Turkey[1], the current study identified all mean measurements decreased significantly in the control group also but to a lesser extent. A study reported that rest with elevating feet and legs helps in reducing dependent oedema (Kent et al, 1999; Field T, Hemandez-Reif M, Hart S, Theakston H, 1999). Since most of the participants of the current study were living in joint families so due to the cultural influence, they felt hesitant to rest for a longer time in presence of elders during the day. The possible cause for not resting, narrated by most of the participants was that elderly women of the family emphasize working and walking more during the last trimester to facilitate normal delivery (Kandeel NA, El-Hady MM, Tantawy N. 2019). Despite these cultural factors not resting much during the day, they elevated their legs using a pillow at night which resulted in decreasing lower leg edema.Participants' personal experiences and comments about the effects of the therapeutic massage were found to be mostly positive and very satisfying in the present study. Nearly 79% of the participants reported feeling better, stating that the therapeutic massage was comforting and relaxing and a few commented that their shoes fit easily after sessions of massage. However, about 21% of the participants did not find any change. Their experience was ineffective in reducing the swelling of the feet. The feelings of participants about therapeutic massage were remarkably consistent and similar to the responses of women in the preceding study by Mollart[3] which none of the other studies has explored in the literature review. Lymphatic reflexology significantly assisted women in coping with symptoms in late pregnancy with a reduction in the levels of stress, tension, anxiety, discomfort, irritability, pain, and tiredness. Therapeutic massage was conducted for the first time in Pakistan using an adequate and properly calculated sample size to find the effectiveness of the therapeutic massage. No adverse experience was reported by the treatment

group who received a therapeutic massage. Participants were found to be interested, cooperative and responsible to complete their treatment sessions. Therapeutic massage was carried out by principal investigators intentionally to reduce any chance of bias. Measurements were also taken by the principal investigator to reach accurate recordings.

LIMITATIONS

The study was conducted only in one setting limiting its generalization. Collected data were filled in by the primary researcher after asking questions to the participants as most of the participants could not read or write which might enhance the subjectivity of the outcome. The massage was conducted in the outpatient department due to the non-availability of a separate room.

RECOMMENDATIONS

Therapeutic massage is recommended to be used in midwifery practice as it is a non-medicated, woman-friendly and cost-effective intervention. Furthermore, there is a need for planned strategies in clinical settings for educating pregnant women in earlier months regarding dietary intake and mild exercises of the lower extremities.

CONCLUSION

The findings of the current study signify that consistent therapeutic massage can be a valuable strategy to decrease edema of lower extremities and the discomforts related to it during pregnancy. Therapeutic massage was found to be a more effective and superior alternative to routine care to combat normal physiological ankle and foot edema during late pregnancy. The blending of both massage therapy and routine care may reduce the prevalence of edema of the ankle and feet during late pregnancy and also improve overall health outcomes during pregnancy.

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